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Parallel Computing  
Assignment 2 (13 Marks)  
Deadline: 1st November 11:59PM

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1. Stencil computations (13 marks): Consider a 2D grid of data stored as a Matrix of doubles. The elements are updated iteratively until some condition is satisfied. The element's new value is the average of the element's current value and the current values of its four neighbors. Every element in the matrix is similarly updated. At the end of each iteration, the maximum value change is determined (the difference between its old value and its current computed value). That maximum of all these differences is computed across the entire matrix. If the maximum difference for a given iteration falls below a given threshold, the calculation ends, else, the next iteration starts. To read: [https://en.wikipedia.org/wiki/Iterative\\_Stencil\\_Loops](https://en.wikipedia.org/wiki/Iterative_Stencil_Loops)

- Parallelize the computation using threads.
- Any number of threads can be launched.
- Input to the program: Matrix size (n), and threshold (t). Example: `./pgm 10 0.01` (A 10X10 random matrix of doubles is generated (using the function given), and the computation is run till the threshold value of 0.01 is met).
- Time the computation after the matrix generation using the timer provided (Do not time with dangling threads).
- Output: Time, number of iterations, and number of threads launched.
- For a fixed threshold, vary the value of n, and plot the computation time. i.e., n along x-axis, and time along y-axis.
- Upload the code as a single file (your roll number in lower case should be used to name the file). Also upload the plot as a single file/image.
- Any kind of cheating will be heavily penalized. Please refer to the discussion we had in class regarding this.
- The best performing code will win a prize.

2. Parallelize N-queens problem. Input: n, Output: Number of solutions (5 marks).

Please note that the maximum marks you can get in this assignment is 13. You can choose to skip the second question, and only attempt the first.